



МЕДИЦИНСКИ УНИВЕРСИТЕТ – СОФИЯ
Medical University - Sofia
МЕДИЦИНСКИ ФАКУЛТЕТ
Faculty of Medicine – Dean's Office

CLINICAL CHEMISTRY CURRICULUM

The curriculum has been adopted at the meeting of the Faculty Council 36/28.11.2019

Annotation of the academic discipline

Clinical chemistry is a part of clinical laboratory. Clinical laboratory is an independent specialty and scientific discipline on the area of medicine. It is based on quantitative and qualitative investigation of biological fluids, cells and tissues and provides information about screening, prevention and early detection of diseases, diagnosis, monitoring of the treatment, prognostic assessment. Advanced technologies, measurement procedures and research activity in dynamic equilibrium are directed to development of new, clinically useful, biomarkers.

During the course of clinical chemistry, the students should be able to get knowledge on the main aspects of the contemporary laboratory science: highly complex character of the laboratory examination and possible sources of variations; requirements in pre-analytical phase, current analytical principle and analytical method evaluation; reference intervals and biological variations; clinical significance of the results; programs of quality management.

Lectures

Lecture №1. Introduction to clinical chemistry. Organization of clinical laboratory. Biological variations and reference values. Reliability of laboratory results. Quality assurance in clinical laboratory.

Lecture №2. Principles and calibration of quantitative methods in clinical chemistry. Calibration curve. Glucose in biological fluids. Proteins in biological fluids. Methods of determination. Clinical significance of the results.

Lecture №3. Low-molecular non-protein nitrogen substances. Lipids and lipoproteins. Methods of determination. Clinical significance of the results.

Lecture №4. Acid-base balance. Electrolytes and trace elements. Methods of determination. Clinical significance of the results.

Lecture №5. Enzymes. Cardiac markers. Bile pigments. Methods of determination. Clinical significance of the results. Drugs in biological fluids. Management of drug therapy.

Lecture №6. Hemoglobin. Methods of determination. Clinical significance of the results. Hemostasis. Laboratory tests for evaluation of coagulation and fibrinolysis. Urinalysis. Functional investigation of kidneys.

Lecture №7. Hormones and tumour markers in biological fluids. Methods of determination. Clinical significance of the results.

Seminars

Seminar №1. Carbohydrates –measurement of glucose in blood and other biological fluids.

Seminar №2. Total protein in blood serum. Calibration curve. Fractionation of proteins. Individual proteins.

Seminar №3. Quality assurance in clinical laboratory. Quality control. Control charts.

Seminar №4. Low-molecular non-protein nitrogen substances. Measurement of urea, creatinine, uric acid, ammonia.

Seminar №5. Lipids and lipoproteins. Measurement of cholesterol, triglycerides, HDL-cholesterol, apoproteins.

Seminar №6. Serum enzymes and isoenzymes. Enzyme activity measurement of ASAT, ALAT, LDH, CPK, CPK-MB, ALP, ACP, CHE, amylase. Cardiac markers-myoglobin, troponin, natriuretic peptides – methods of measurement.

Seminar №7. Revision

Seminar №8. Electrolytes. Measurement of Na, K, Cl, Ca, Mg, inorganic P.

Seminar №9. Acid-base balance. Determination of AB-balance parameters. Clinical significance of the results. **Seminar №10.** Hemoglobin. Hemoglobin types. Methods of determination. Bilirubin in human serum. Methods of measurement.

Seminar №11. Coagulation and fibrinolysis. General scheme of coagulation. Bleeding time, prothrombin time, activated partial thromboplastin time, fibrinogen, D-dimer.

Seminar №12. Urine – physical characteristics; urinalysis - pH, glucose, protein, ketones, bilirubin, urobilinogen, blood. Functional evaluation of kidneys. Clearance tests.

Seminar №13. Trace elements in biological fluids. Measurement of serum iron, TIBC, serum copper, zinc, selenium. Management of drug therapy-analysis of drugs in biological fluids

Seminar №14. Hormones. Tumor markers. Methods of measurement – fluorometry analysis, immune assays with labels.

Seminar №15. Revision.

Ongoing assessment – forms, frequency

- regular discussion on the passed topics; tests with “multiple-choice questions” principle – 1 test during the Seminar 7
- seminars 7 and 15 – discussion, considerations of specific aspects of certain matters
- score, put on the student card at the end of semester; the score reflects the complex work during the semester including also the protocols, prepared for every passed thematic unit.

Syllabus of clinical chemistry examination - Pharmacy Students course III, VI-th semester

- 1. Introduction to clinical chemistry. Organization of clinical laboratory. Quantitative methods in clinical chemistry.
- 2. Calibration curve. Rules for preparation of calibration curve.
- 3. Analytical reliability. Analytical inaccuracy, trueness and imprecision. Analytical specificity and sensitivity. Detection limit.
- 4. Quality assurance management in clinical laboratory. Errors in clinical chemistry-types and origin.
- 5. Internal Laboratory Quality Control. Control Chart – construction and purpose. External Quality Assessment.

- 6. Interferences in clinical chemistry. Analytical interference – effects of endogenous components and effect of exogenous components. In vitro analytical interference: spectral (hemolysis, icterus, lipidemia) and chemical. In vivo pharmacological interference.
- 7. Reference ranges in clinical laboratory. Biological variations.
- 8. Carbohydrates in biological fluids. Glucose – methods of determination. Glucose Tolerance Test. Clinical significance of the results.
- 9. Proteins in biological fluids. Determination of Total Protein. Clinical significance of the results.
- 10. Fractionation of proteins in biological fluids. Individual Proteins. Methods of analysis. Clinical significance of the results.
- 11. Low molecular non-protein nitrogen compounds – urea. Methods of urea determination. Clinical significance of the results.
- 12. Creatinine. Methods of creatinine determination. Clinical significance of the results.
- 13. Uric acid and ammonia in biological fluids. Methods of determination. Clinical significance of the results.
- 14. Lipids in blood. Types. Lipoproteins. Determination of total cholesterol and cholesterol fractions. Result clinical significance.
- 15. Triglycerides. Methods of determination. Apoproteins. Clinical significance of the results.
- 16. Enzymes in biological fluids. Methods of determination. Isoenzymes. Isoforms. Methods of determination.
- 17. Aminotransferases - AST, ALT. Methods of determination. Clinical significance of the results.
- 18. Alkaline phosphatase. Isoenzymes and isoforms. Methods of determination. Clinical significance of the results.
- 19. γ -glutamyl transferase Methods of determination. Clinical significance of the results.
- 20. Creatine kinase. Lactate dehydrogenase. Isoenzymes and isoforms. Methods of determination. Clinical significance of the results.
- 21. α -amylase in blood and urine. Methods of determination. Clinical significance of the results.
- 22. Cardiac markers – myoglobin, troponins, natriuretic peptides. Methods of determination. Clinical significance of the results.
- 23. Classification of bio-elements. Blood electrolytes. Sodium and potassium. Methods of determination. Clinical significance of the results.
- 24. Calcium and magnesium in biological fluids. Methods of determination Clinical significance of the results.
- 25. Chloride ions and inorganic phosphorous. Methods of determination. Clinical significance of the results.
- 26. Classification of microelements. Iron and Total Iron Binding Capacity (TIBC). Methods of determination. Clinical significance of the results.
- 27. Copper, zinc and selenium in biological fluids. Methods of determination. Clinical significance of the results.
- 28. Bilirubin in blood. Methods of determination. Clinical significance of the results.
- 29. Acid-base balance. Buffer systems in blood. Determinations of ABB parameters. Clinical significance of the results.
- 30. Hemoglobin. Methods of determination. Clinical significance of the results.
- 31. Hemostaseology. Coagulation. Fibrinolysis. Regulation. Methods of hemostaseology evaluation.
- 32. Fibrinogen. Methods of determination. Clinical significance of the results.

- 33. Prothrombin Time, Activated Partial Thromboplastin Time. Methods of determination. Clinical significance of the results.
- 34. Evaluation of fibrinolysis, Fibrin Degradation Products, D-dimer. Methods of determination. Clinical significance of the results.
- 35. Urine, urine formation. Urinalysis. Chemical analyses of urine protein, glucose, ketones, bile pigments, blood, nitrite test. Clinical significance of the results.
- 36. Hormones. Classification. Methods of determination in biological fluids. Clinical significance of the results.
- 37. Pituitary gland hormones and thyroid hormones. Methods of determination. Clinical significance of the results.
- 38. Reproductive hormones. Methods of determination. Clinical significance of the results.
- 39. Cortisol and catecholamines in blood and urine. Methods of determination. Clinical significance of the results.
- 40. Functional tests for kidney evaluation. Clearance measurements. Clinical significance of the results.
- 41. Tumor markers – methods of determination and clinical significance of the results.
- 42. Drugs in biological fluids. Management of drug therapy. Clinical significance of the results.

Academic literature:

Title, authors, publisher, ISBN, year of publication

1. **Guide to practical trainings in clinical chemistry for pharmacy students**, Medical University-Sofia, Publishing house LAX BOOK, Plovdiv 2014. ISBN 978-954-8326-97-1.
2. **Clinical Chemistry, Principles, Techniques, Correlations**, Michael Bishop, Edward Fody, Larry Schoeff, Publisher: Lippincott Williams and Wilkins, Seventh Edition 2013. ISBN-13: 978-1451118698. Eight Edition 2018: Walters Kluwer ISBN 978-1496335586.
3. **Additional references**, pointed at the end of every topic by the authors in (1).